K2 Observations of GJ 876: a M3.5 star with at least 4 planets, including the hot super-Earth GJ 876 d

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GJ 876 (EPIC 206019387, Kp=9.13) is a M3.5 dwarf only 4.72 pc away from our Sun and is the closest known multiple planets system. Four exoplanets have been found to orbit the star (Rivera et al. 2010, ApJ, 719, 890, and references therein). Among these, GJ 876 d is a "hot super-Earth", with a mass of 6.83 ± 0.40 M_{Earth}, an orbital period of 1.94 d, and a significant eccentricity e~0.20 (Rivera et al. 2010). GJ 876 is also a rare example of a planetary system with two Jupiters, GJ 876 b & c, in resonance 2:1 (P_{orb}=61 d and 30 d, respectively). Dynamical modeling the RV measurements strongly constrained the orbital inclinations of the planets, which are found to be around i~50° (thus non transiting) and coplanar (Correia et al. 2010, A&A, 511, 21).

We request K2 **long-cadence observations** of GJ 876 in order to:

- Observe the photometric variability of GJ 876 and determine its level of activity (spot, flares, etc.). Taking into account the activity of the host is very important when studying exoplanetary atmospheres, especially for M stars.
- Attempt to detect the phase effect (modulation of the flux along the orbit) of the hot super-Earth GJ 876 d, which is most probably tidally locked (P_{orb}=P_{rot}).

Observing the photometric variability of GJ 876 will also confirm/refute the claimed stellar rotation period of 96.7 ± 1.0 d (Rivera et al. 2005, ApJ, 634, 625). Determining the stellar rotation period will allow us to determine the inclination of the host star by comparison with the measured v_{eq} sini = 0.16 km/s (Correia et al. 2010). From there we will infer the obliquity of GJ 876 (the angle between the stellar spin axis and the planetary orbital axis) and see if it is close to zero, as it is the case for the Sun and also for the two exoplanetary systems Kepler-50 and Kepler-65 (Chaplin et al. 2013, ApJ, 766, 101). On the contrary, Huber et al. (2013, Science, 342, 331) presented the case of Kepler-56 b & c, which are in a 2:1 resonance and both transit (having no mutual inclination). From asteroseismic mode splitting, the stellar spin is measured **inclined** with respect to their orbital plane. It has been postulated that both planets were lifted out of the equatorial plan by the Kozai-Lidov mechanism. GJ 876 b & c are also in resonance 2:1, which means that if the Kozai-Lidov mechanism also acted in this system, it would have lifted the entire planetary system out of alignment with its host.

The detection of the phase effect of the hot super-Earth GJ 876 d will bear indication on the presence of an atmosphere, and thus on the nature of the super-Earth: gas planet, rocky planet with a thin atmosphere, bare rock planet? The presence of an atmosphere is in itself interesting information, since the atmospheric retention of a super-Earth in a very short-period orbit around an M star is an open question. M stars have much longer active phases (Extreme-UV radiation, winds, etc.) compared to solar-like stars, and these processes are the main mechanisms for driving atmospheric escape. K2 offers a unique opportunity to observationally put strong constraints on the presence of an atmosphere for a tidally locked close-in super Earth orbiting an M star.